OPERATING INSTRUCTIONS

1302-A

TYPE 1302-A OSCILLATOR

. . . . SINCE 1915
manufacturers of
electronic apparatus
for science and industry

GENERAL RADIO COMPANY

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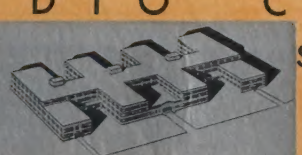

SA

1-H

OPERATING AND MAINTENANCE INSTRUCTIONS

TYPE 1302-A OSCILLATOR

Form 661-H
December, 1958

GENERAL RADIO COMPANY

CAMBRIDGE 39 MASSACHUSETTS

SPECIFICATIONS

FREQUENCY RANGE:	10 to 100,000 cps in four ranges.
FREQUENCY CONTROL:	Main control dial engraved from 10 to 100 cps over 8¾ in. Four multiplier switches multiply scale frequencies by 1, 10, 100, and 1000.
FREQUENCY CALIBRATION:	±(1½% + 0.2 cps).
FREQUENCY STABILITY:	Warm-up drift less than 1% in first 10 min, less than 0.2% during next hour.
OUTPUT IMPEDANCE:	Balanced 600 ohms and grounded 5000 ohms. Internal impedance of 600-ohm output is constant at 550 ohms unless low output terminal is grounded. When low output terminal is grounded, output impedance is 300 ohms, grounded. In 5000-ohm output impedance position, internal impedance of the oscillator averages about 400 ohms.
OUTPUT VOLTAGE:	At least 20 v open circuit on 5000-ohm output, and 10 v open circuit on 600-ohm output. The output voltage is constant within ±1.0 db over entire frequency range.
OUTPUT POWER:	80 mw max into a 5000-ohm load; 40 mw max into a balanced 600-ohm load; 20 mw into a 300-ohm load.
WAVEFORM:	Total harmonic content less than 1% for all output values and at all frequencies, for 5000-ohm output; less than 0.5% for 600-ohm output.
A-C HUM:	24 mv max with 5000-ohm output; 12 mv max with 600-ohm output.
TERMINALS:	Jack-top binding posts with standard ¾-in. spacing. The separate ground terminal has a strap that can be used to ground the low output terminal. Output is also available at a multipoint connector at the rear of the instrument. A mating connector is supplied.
MOUNTING:	Relay-rack panel easily adapted for table mounting by addition of two frames at ends of panel.
POWER SUPPLY:	105 to 125 (or 210 to 250) v, 50 to 60 cps. Power consumption is 90 watts.
ACCESSORIES SUPPLIED:	Type CAP-35 Power Cord, Type 274-ND Shielded Plug, multipoint connector, and spare fuses.
DIMENSIONS:	Panel width 19 in., panel height 7 in., depth behind panel 12 in.
WEIGHT:	30 lb.

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U.S. Patent No. 2,173,427

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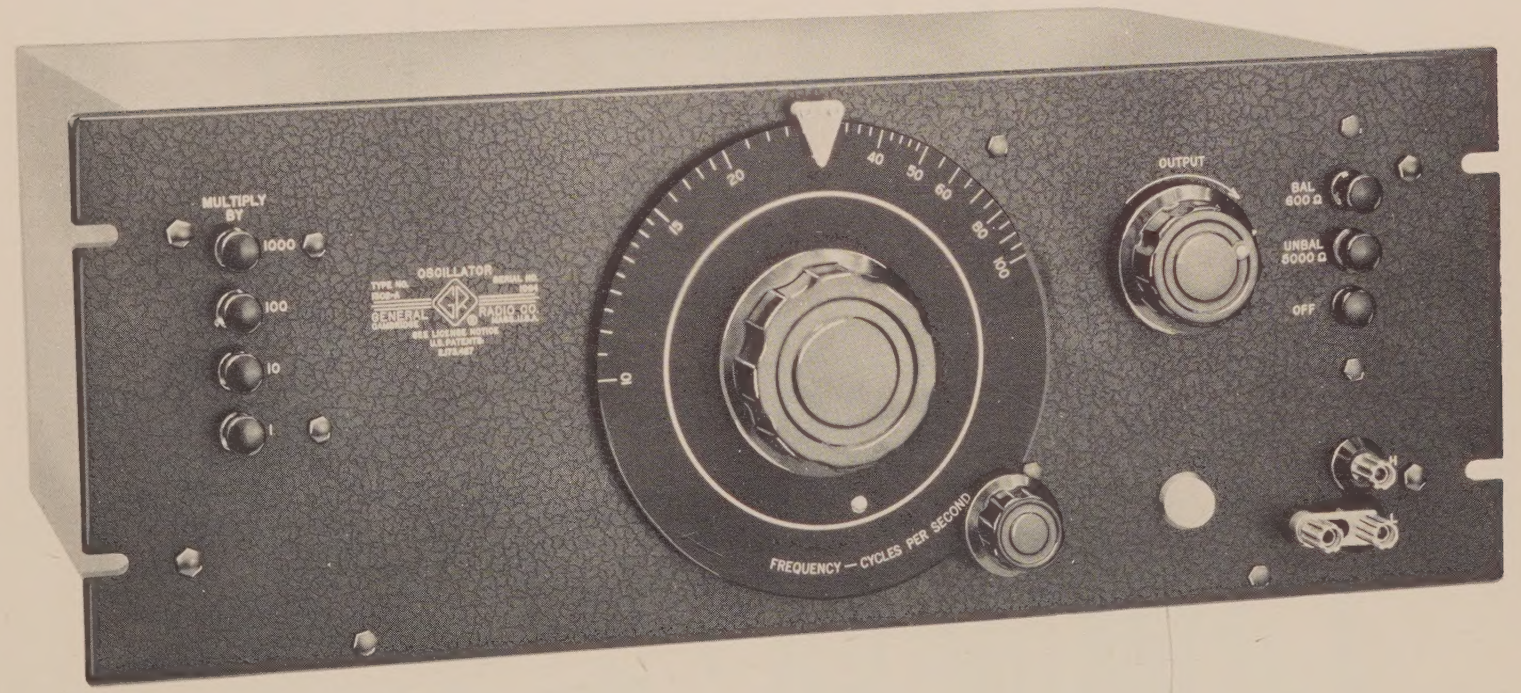


Figure 1. Type 1302-A Oscillator.

TYPE 1302-A OSCILLATOR

Section 1
INTRODUCTION

1.1 GENERAL. The Type 1302-A Oscillator (Figure 1) is a versatile power source for bridge and other measurement devices. It has a wide frequency range and excellent amplitude stability.

1.2 DESCRIPTION.

1.2.1 GENERAL. The Type 1302-A Oscillator is an r-c oscillator employing an inverse feedback circuit. The frequency-determining network is a modified form of a Wien bridge, in which the capacitive elements are controlled by the main frequency dial, and two resistive elements are selected by a range switch. The output of this network balances to a null at one frequency and results in a negative feedback voltage at all other frequencies. This condition can cause oscillations of the amplifier at one frequency, if a positive feedback voltage is introduced that has just enough amplitude to equal the losses around the loop.

The amplitude of oscillation is controlled by means of the positive feedback voltage, which is fed from the junction of two additional resistance arms added in parallel to the reactance arms of the bridge. The ratio of these resistances determines the amount of positive feedback and hence the amplitude of oscillation. One of the arms is an incandescent lamp with a nonlinear resistance, and the values are so chosen that any change in oscillator amplitude changes the ratio of the two resistance arms the proper amount to make a compensating change in the positive feedback voltage. Thus an avc action is produced on the oscillator amplitude.

A buffer amplifier isolates the output control from the oscillator section and thus prevents reaction of the control upon the frequency of the oscillator. The output control is located ahead of the final amplifier so that it will not affect the balance and magnitude of the internal output impedance.

Negative feedback in the amplifier reduces harmonic distortion, provides a flat frequency response, and minimizes the effects of tube characteristics. Transformers are not used because of the wide frequency range and the low distortion requirements at low frequencies.

1.2.2 CONTROLS. The following controls are on the panel of the Type 1302-A Oscillator:

Name	Type	Function
FREQUENCY	Continuous knob and dial	Selects (with multiplier) output frequency.
MULTIPLY BY	Push buttons (4)	Selects range of output frequency.
OUTPUT	Continuous rotary control	Varies output amplitude.
none	Push buttons (3)	Selects either 600-ohm or 5000-ohm output impedance, or turns instrument on or off.

1.2.3 CONNECTIONS. The following connections are provided on the Type 1302-A Oscillator:

Name	Type	Function
H, L, G	Jack-top binding posts (3)	High and low output terminals and ground terminal, respectively.
none	Multipoint connector	Alternate output connection.

1.2.4 ACCESSORIES. A power cord, Type 274 Shielded Plug, multipoint connector, and spare fuses are supplied with the instrument.

Section 2
OPERATING PROCEDURE

2.1 POWER SUPPLY. Instruments are normally shipped connected for 115-volt operation, but can be easily adapted to 230-volt use. To change to the 230-volt connection, connect together transformer terminals 2 and 3, and connect the line to terminals 1 and 4. Then replace the fuses with those of the proper rating (refer to parts list) and reverse the nameplate near the power-input receptacle to read 230 v, 50-60 cycles. Voltage regulators within the instrument eliminate all effects of line-voltage variation, including transients, over the range from 105 to 125 (210 to 250) volts. Also, hum level has been reduced to a minimum and will not exceed 0.2 percent at full output. Input power is about 90 watts.

2.2 FREQUENCY CONTROL. The frequency dial is direct-reading, and covers one decade. A set of four push-buttons provides multiplying factors of 1, 10, 100, and 1000.

2.3 OUTPUT SYSTEM. Either of two output impedances may be selected by means of push-buttons. The UNBAL 5000Ω button is intended for use with 5000-ohm loads, unbalanced to ground. When this button is pushed, the LOW terminal is internally connected to ground. An output of about 80 milliwatts (20 volts) can be obtained with the normal 5000-ohm load, with less than 1 percent harmonic distortion. The effective internal impedance of the oscillator averages about 400 ohms. (See Figure 2.)

Figure 3 gives the distortion-vs-load characteristic of the 5000-ohm output position over a considerable range of load conditions. From this it is seen that a useful output can be obtained for loads of 2500 ohms to open circuit.

The BAL 600Ω button is designed for use with a 500-600-ohm load, and allows an output of 40 milliwatts with a harmonic content of less than 1 percent. The internal impedance is constant at about 550 ohms, and 500-600-ohm lines may be coupled directly to the output.

With the BAL 600Ω button pushed, the output is balanced to ground. For unbalanced operation with the low output terminal grounded, connect the grounding strap between the G and L binding posts. Internal impedance and output power will then be reduced by one half. Failure to connect the grounding strap to the L (low) terminal during unbalanced operation will cause the distortion to increase slightly.

Figure 3 shows the effect of load impedance upon harmonic distortion, in the 600-ohm position, over an impedance range from 50 ohms to open circuit. These data are average values, and the characteristics of individual instruments will differ slightly from the curves shown.

Section 3
SERVICE AND MAINTENANCE

3.1 GENERAL. This service information, together with the information in preceding sections, should enable the user to locate and correct difficulties resulting from normal use. Major service problems should be referred to our Service Department, which will cooperate as much as possible by furnishing replacement parts needed as well as by supplying any necessary information. When notifying our Service Department of any difficulties in the operation or service, please specify the serial and type numbers of the instrument. Also give a complete report of the trouble encountered, and of the steps taken to eliminate the trouble.

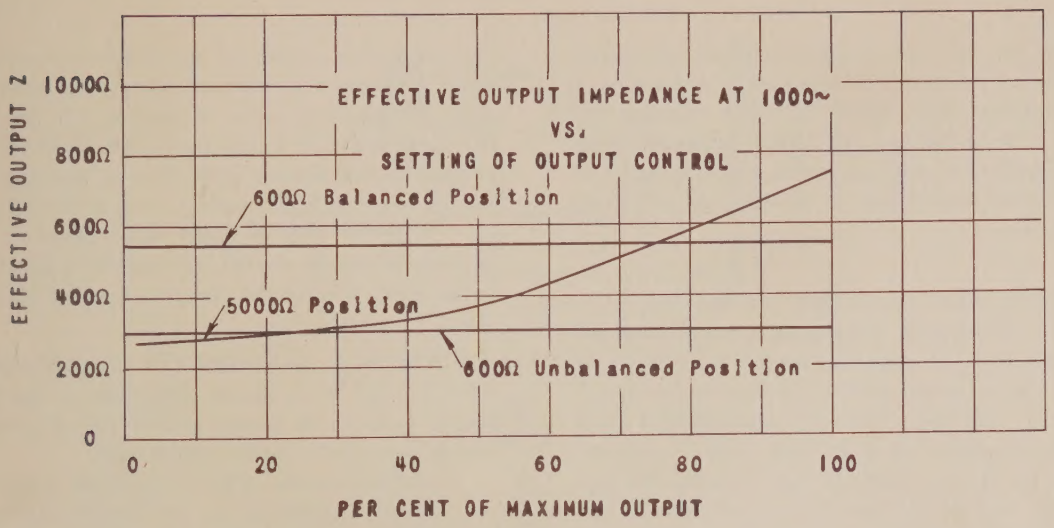


Figure 2. Effective Output Impedance vs Output Control Setting.

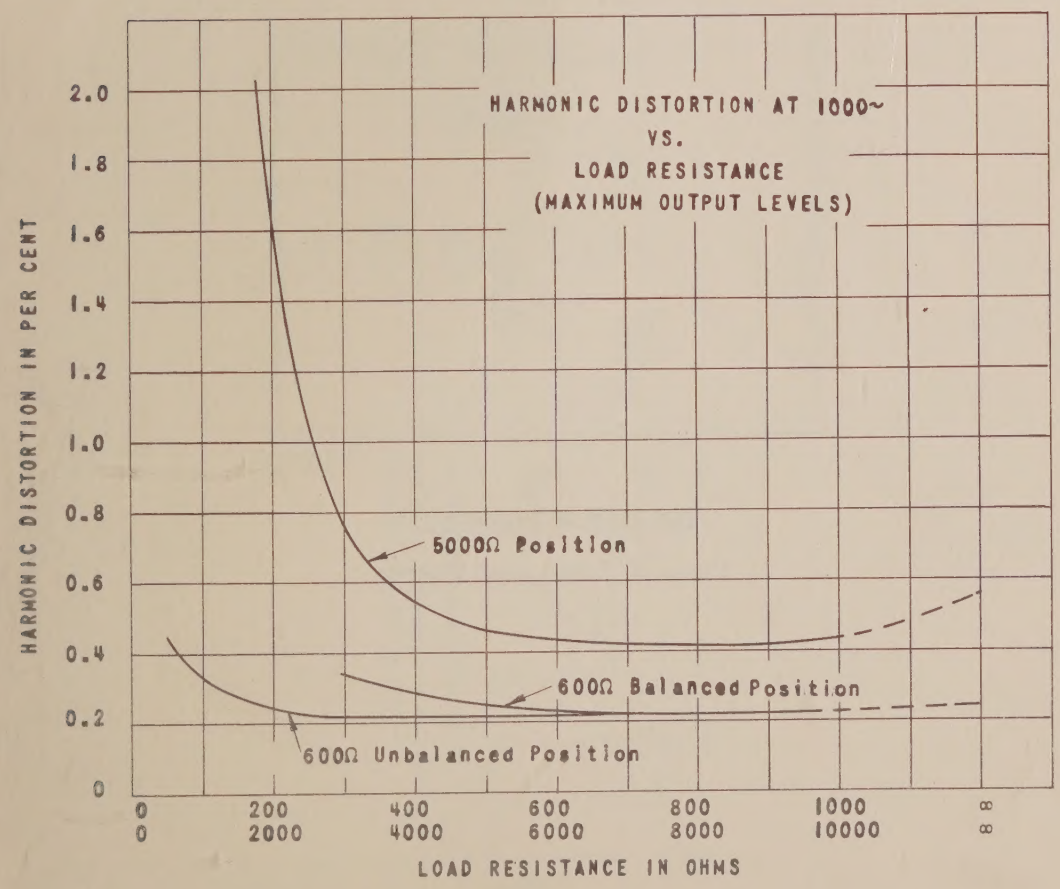


Figure 3. Harmonic Distortion vs Load Resistance.

Before returning an instrument or part for repair, please write to our Service Department, requesting a Returned Material Tag, which includes shipping instructions. Use of this tag will insure proper handling and identification. A purchase order covering repair of material returned should also be included to avoid unnecessary delay.

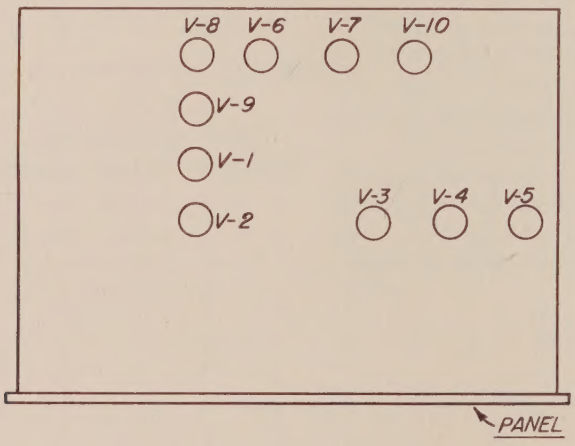
3.2 FREQUENCY CALIBRATION. All four frequency ranges have independent adjustments, permitting the scale calibration to be corrected for any drift that may occur. Two rheostats are used to set the low-frequency end of the dial, and two adjustable capacitors are used for the high-frequency end of the dial. These controls are mounted in the subassembly that includes the frequency range switch, and are clearly marked with the corresponding range positions. It should not be necessary to alter these adjustments unless the instrument has been in use for some time and/or the tubes have been changed.

If for any reason the shield over the tuning capacitor is removed or damaged, it may be found that the dial is slightly in error, equally on all ranges. The two capacitors C10 and C11 will control the scale length to produce the desired correction by shifting the calibration near the high-frequency end of the dial.

Whenever any of these adjustments is made, it is better to change the two capacitors by equal amounts, rather than to make the entire correction on one capacitor.

3.3 INTERNAL ADJUSTMENTS. The amplifier is factory-adjusted for minimum distortion on the 5000-ohm output position by means of R22 (see Figure 6), and should not require further adjustment.

An adjustment (R12) is provided to compensate for possible variations in the stabilizing lamp, P2. Most lamps will work without readjustment of this control, but occasionally a replacement lamp might require a resetting of this control to obtain a stable output voltage.



TOP VIEW OF INSTRUMENT

Figure 4. Tube Layout Diagram.

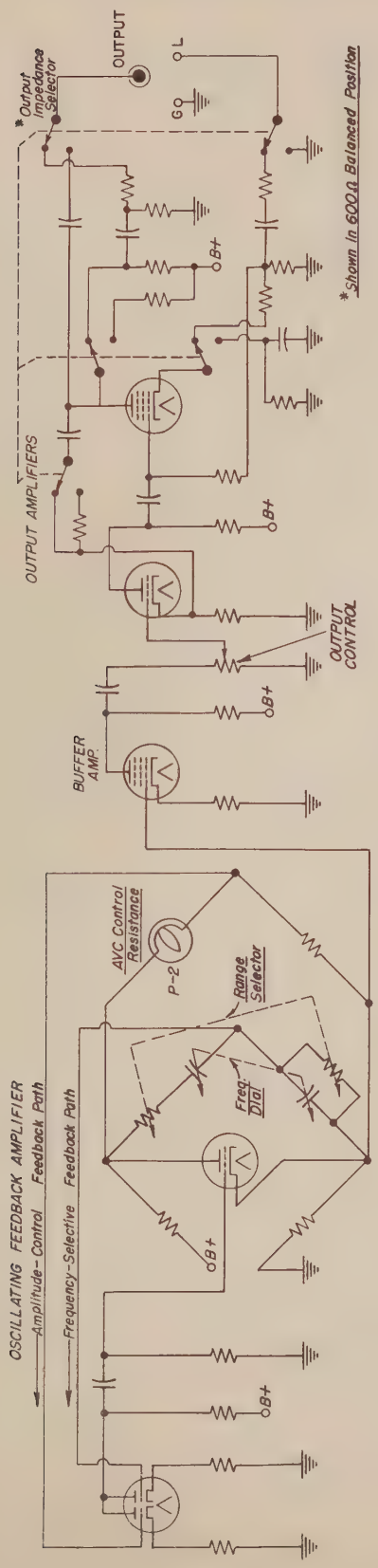


Figure 5. Elementary Schematic Diagram

Section 4
PARTS LIST

RESISTORS (NOTE B)

		GR NO. (NOTE A)
R1	75 k ± 5%, 1/2w	REC-20BF
R2	75 k ± 5%, 1/2w	REC-20BF
R3	62 k ± 5%, 1/2w	REC-20BF
R4	1.0 M ±10%, 1/2w	REC-20BF
R5	230 } ±0.5%	510-344
R6	1.77 k }	
R7		
R9	4 k ±0.5%	510-390-2
R10		
R11	1.5 k ±10%, 1w	REW-4C
R12	1 k ±10%	POSW-3
R13	470 ±10%, 1/2w	REW-3C
R14	2.4 k ± 5%, 2w	REC-41BF
R15	27 k ±10%, 1w	REC-30BF
R16	7.5 k ± 5%, 10w	REPO-44
R17	50 k ±10%	410-413
R18	5.1 k ± 5%, 1/2w	REC-20BF
R19	56 k ±10%, 1w	REC-30BF
R20	1.0 M ±10%, 1/2w	REC-20BF
R21	470 ±10%, 1/2w	REW-3C
R22	500 ±10%	POSW-3
R23	8 k ± 5%, 10w	REPO-44
R24	2 k ± 5%, 10w	REPO-44
R25	390 ±10%, 1w	REW-4C
R26	620 ± 5%, 1w	REW-4C
R27	2.2 k ±10%, 1w	REW-4C
R28	240 ± 5%, 1/2w	REW-3C
R29	240 ± 5%, 1/2w	REW-3C
R30	15 k ±10%, 1/2w	REC-20BF
R31	100 k ±10%, 1/2w	REC-20BF
R32	560 k ±10%, 1w	REC-30BF
R33	10 k ±10%, 1/2w	REC-20BF
R34	10 k ±10%, 1/2w	REC-20BF
R35	470 k ±10%, 1/2w	REC-20BF
R36	27 k ±10%, 2w	REC-41BF
R37	680 k ±10%, 1w	REC-30BF
R38	10 k ±10%, 1/2w	REC-20BF
R39	2.2 k ±10%, 1/2w	REC-20BF
R40	500 ±10%	POSW-3
R41	15 ±10%, 1/2w	REW-3C
R42	1 k ±10%, 1/2w	REC-20BF
R43	10 k ±10%, 1/2w	REC-20BF
R45	56 ±10%, 1/2w	REW-3C
R46	56 ±10%, 1/2w	REW-3C
R101	11.50 M ± 1%, 5w	REF-1-4
R102	1.0 M ±20%	POSC-11

RESISTORS (NOTE B)

		GR NO. (NOTE A)
R103	1.0 M ±20%	POSC-11
R104	11.50 M ± 1% 5w	REF-1-4
R105	1.15 M ± 1%	REPR-18-E
R106	100 k ±20%	POSC-11
R107	100 k ±20%	POSC-11
R108	1.15 M ± 1%	REPR-18-E
R109	115 k ± 1%	REPR-17-E
R110	10 k ±20%	POSC-11
R111	25 k ±10%	POSC-11
R112	115 k ± 1%	REPR-17-E
R113	11.50 k ± 1%	510-390-2
R114	1.5 k ±20%	POSC-11
R115	1.5 k ±20%	POSC-11
R116	11.50 k ± 1%	510-390-2

CAPACITORS (NOTE C)

		GR NO. (NOTE A)
C1	50 150dcwv }	COEB-201
C2	50 150dcwv }	
C3	0.05 ±10%	COM-50B
C4	7-45μμf	COT-12
C5	7-45μμf	COT-12
C6	40 450dcwv	COE-18
C7	80 450dcwv	COE-201
C8	80 450dcwv	COE-201
C9	600 μμf ±10%	COM-30B
C10	7-45μμf	COT-12
C11	7-45μμf	COT-12
C12	1206μμf }	COA-23-2
C13	1206μμf }	
C14	(NOTE D)	COM-20B
C15	400 μμf ±10%	COM-20B
C16	20 450dcwv	Part of COEB-200
C17	2.0 ±10%	COL-15
C18	0.05 ±10%	COM-50B
C19	120 50dcwv	Part of COEB-200
C20	125 300dcwv	COE-202
C21	100 25dcwv	COE-203
C22	20 450dcwv	COE-200
C23	20 450dcwv	COE-5
C24	5 ±10%	COL-9
C25	20 450dcwv	COE-200
C26	20 450dcwv	Part of COEB-200
C27	150μμf ±10%	COM-20B

CAPACITORS (NOTE C)

		GR NO. (NOTE A)
C101	7-45μμf	COT-12
C102	50μμf ±10%	COM-20B
C103	7-45μμf	COT-12
C104	7-45μμf	COT-12
C105	50μμf ±10%	COM-20B
C106	7-45μμf	COT-12
C107	7-45μμf	COT-12
C108	50μμf ±10%	COM-20B
C109	7-45μμf	COT-12
C110	7-45μμf	COT-12
C111	7-45μμf	COT-12
C112	50μμf ±10%	COM-20B

F1	FUSE, 1.25-amp, Slo-Blo, for 115-v operation	FUF-1
F1	FUSE, 0.6-amp Slo-Blo, for 230-v operation	FUF-1
F2	FUSE, 1.25-amp Slo-Blo, for 115-v operation	FUF-1
F2	FUSE, 0.6-amp Slo-Blo, for 230-v operation	FUF-1
P1	PILOT LIGHT, 6.3v, Mazda Type 44	2LAP-939
P2	CONTROL LAMP, 120v, 3w	2LAP-1
PL1	PLUG	ZCDPP-10
S1	SWITCH	SWPM-13-2
S2	SWITCH	SWPM-12-2
T1	TRANSFORMER	365-455
SO1	SOCKET	CDMS-1401-4

TUBES

V1	6SL7-GT	V6	6B4-G
V2	6V6-GT	V7	6B4-G
V3	6AK6	V8	6SL7-GT
V4	6J5-GT	V9	0D3
V5	6F6	V10	5V4-G

NOTES

(A) General Radio Part No. designations for resistors and capacitors are as follows:

COA - Capacitor, air
COE - Capacitor, electrolytic
COEB - Capacitor, electrolytic block
COL - Capacitor, oil
COM - Capacitor, mica
COT - Capacitor, trimmer
POSC - Potentiometer, composition
POSW - Potentiometer, wire-wound
REC - Resistor, composition
REF - Resistor, film
REPO - Resistor, power
REPR - Resistor, precision
REW - Resistor, wire-wound

(B) Resistances are in ohms, unless otherwise indicated by k (kilohms) or M (megohms).

(C) Capacitances are in microfarads, unless otherwise indicated by μμf (micromicrofarads).

(D) Value determined in General Radio laboratory.

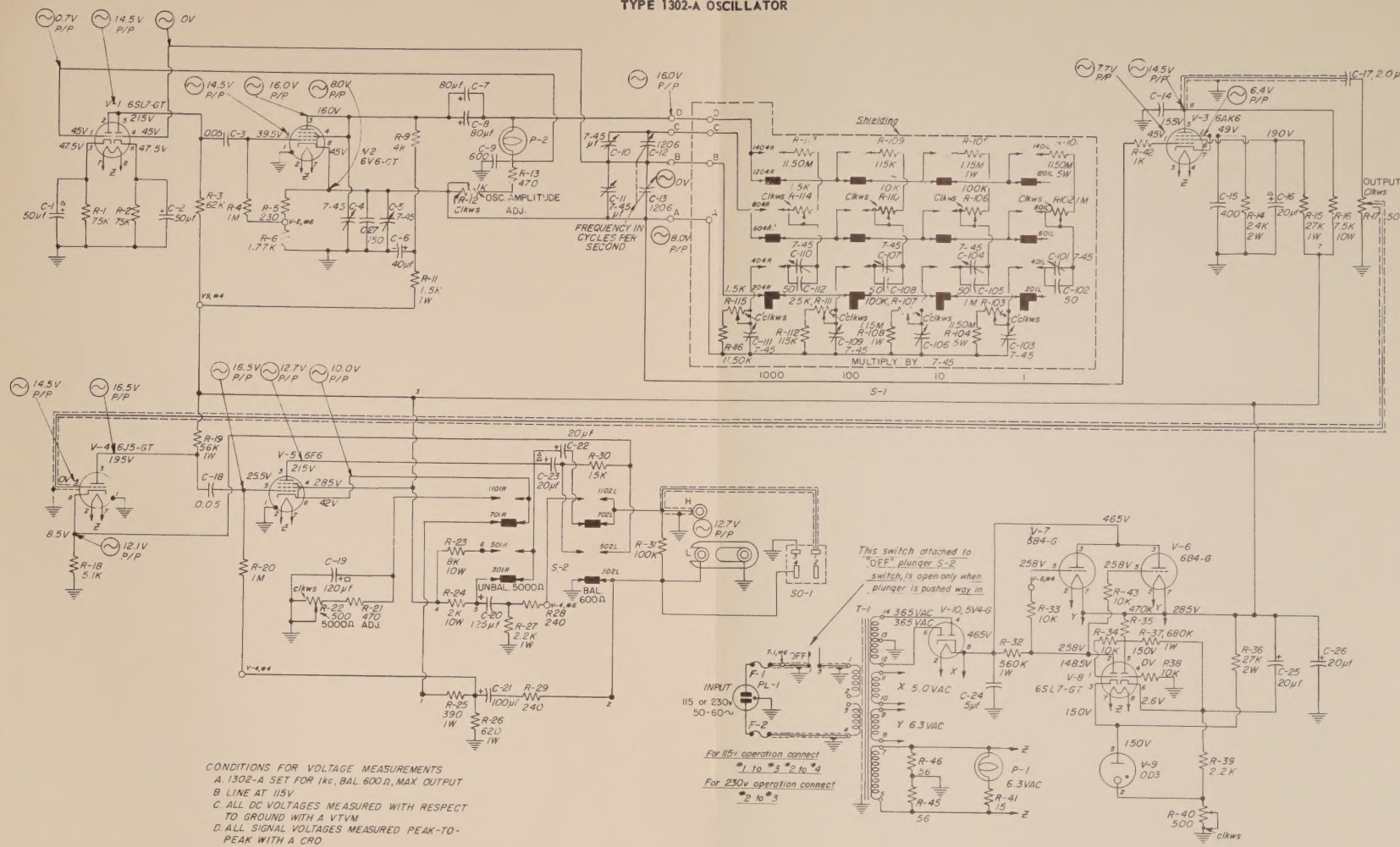


Figure 6. Detailed Schematic Diagram.

GENERAL RADIO COMPANY

275 MASSACHUSETTS AVENUE, CAMBRIDGE 39, MASS.
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DISTRICT OFFICES

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